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# DEPARTMENT OF AGRICULTURE.

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# AGRICULTURAL CIRCULAR

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Vol. 2.] FEBRUARY—MAY, 1921. [No. 2.


## DEPARTMENTAL NOTES.

A bonus of £2 was recently paid to Manbahadur, a storekeeper of Qaloa, for having supplied to the Rice Mill, Suva, a quantity of at least two tons of suitable paddy in good condition, the produce of his land and produced in one season. Manbahadur complied with the conditions under which 10 bonuses for paddy growing were offered in September, 1918.

The notice as to the offer of the bonuses is to be found on page 487 of the *Royal Gazette for* 1918.

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The New Zealand Government has agreed to the importation of citrus fruits into the Dominion subject to the following regulations:—

(*a*) the authorities in the Islands to erect at ports of shipment suitable sheds having all openings covered with wire gauze;
(*b*) all fruit to be in the above sheds at least five days before being packed;
(*c*) no fruit to be exported without going through the said sheds;
(*d*) all fruit to be sorted and packed under Government supervision;
(*e*) all fruit to be accompanied by a certificate stating that it had been for five days in the Government sheds before being packed and that in the opinion of the Inspector it was free from fruit fly and other diseases.

A shipment of 344 cases of mandarins was made to Auckland per s.s. "Tofua" in May in accordance with the above conditions. The consignment arrived in good condition and on receipt of cabled advices the fruit was being sold as high as 30s. per case.

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It is notified, for general information, that the importation from the United States and the Dominions of Canada and New Zealand of all plants and fruits of the natural order *Rosacæa*, which comprises apples, pears, quinces, medlars, cherries, plums, roses, &c., is prohibited owing to the prevalence of "Fire Blight" in the countries named.

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It is stated in the *Journal of the Jamaica Agricultural Society* for December, 1920, that the banana borer in that island is a pest which makes steady advances, and that it is only by clean cultivation and regular trapping that it can be checked. Trapping is done by cutting pieces of fresh stem and putting these along the rows of trees. Every three or four days the traps should be destroyed.

## THE TRANSPARENT COCONUT SCALE ASPIDIOTUS DESTRUCTOR AND ITS ENEMIES IN SOUTHERN PACIFIC.

By H. W. Simmonds, Acting Government Entomologist.

This well-known scale, one of the worst diseases that the coconut grower has to contend with, was first reported in Fiji on bananas, and subsequently was found to be spreading rapidly to coconuts on Ovalau, Moturiki, Vitilevu, Beqa, and Kadavu.

In the Society Islands it was apparently introduced into Tahiti about 1894, whence it spread rapidly to Moorea, Raiatea and the other islands to the windward, and later to the Paumotus. Hitherto it has not been reported from Samoa, Tonga or the Cook Group.

### APPEARANCE.

Trees attacked show patches of yellow on the foliage, caused by the insect sucking up the sap from the section observed. These patches may be of such an extent as to completely destroy the bulk of the foliage and even go so far as to actually kill the tree. The effect on the yield is most marked and one of the Paumotus which formerly produced 600 tons of copra per annum now gives less than 200 tons, and this is not an extreme instance. Yellowness of the leaves may also arise from other causes such a drought, bad drainage, beetle, &c., but in all such cases the yellowness starts from the tip of the leaf working backwards, whilst, when *A. destructor* is present, the yellowness commences as a patch seldom near the extremity of the foliage.

When such a leaf is examined it will be found to be covered underneath with a mass of dull yellow or whitish incrustation. This is formed by the scales under which the insect which causes the disease actually lives. Should such a fully-grown specimen be held against the light the heart-shaped canary-coloured female can be clearly seen by the aid of a small pocket lens lying beneath the circular covering scale, whilst at the same time the male can be observed within its more oval-shaped covering. At this stage the male is fully developed and its red body and its batadore-shaped wings are easily visible. Shortly afterwards the male emerges and can be observed crawling about amongst the females.

### LIFE HISTORY.

These latter now produce their eggs, which form three to four concentric rings containing not less than 80 eggs lying between the rapidly shrinking body of the mother and the outer ring of the covering scale. About seven days after the eggs are laid they begin to hatch and the young larvæ move out from under their parental covering leaving their white cast skins behind which give the whitish appearance to the underside of the leaf.

The newly-hatched *Aspidiotus* is oval in form and has antennæ and three pairs of legs and proceeds to crawl about until it finds a suitable spot, when it quickly settles down and inserts its proboscis into the tissues of the leaf and commences to suck the juices up. Very often within six hours of leaving the parent scale the young larva has settled down, lost its legs and all power of movement, and become a circular dot on the under surface of

the leaf. About eleven days later a second stage is apparent, when the first cast skin of the larvæ forms a central cover to the scale surrounded by a ring of secretion. On the fourteenth or fifteenth day the eyes of the male pupa could be observed lying within the oval scales, whilst on the twenty-first day the circular female scales were observed to contain their full-grown heart-shaped bodies. These latter commenced to produce their ova on the twenty-fifth day, and at the same time the winged males were observed moving amongst them. The ova hatched, and the larvæ began to move out on the thirty-second day, continuing until the thirty-seventh day, when all had emerged, thus taking 38 days to fully complete their life cycle. This cycle may be delayed in cold weather.

METHODS OF DISTRIBUTION OF ASPIDIOTUS DESTRUCTOR.

If the leaves are old or heavily infected with *Aspidiotus destructor* the young larva does not immediately settle down to feed, but continues to wander about when it sometimes finds a new leaf, but large numbers seem to perish. At such times wind probably plays the most important part in carrying the larvæ from tree to tree, and I am told that at times in the Paumotus they fall on one's clothing like yellow dust. In carrying the disease from island to island man is doubtless the chief agent, and I have several times seen young affected trees being taken from Papeete on vessels bound to other islands. It is also possible that large flying insects like the big green Locustid often found settled amongst the scale sometimes carry larvæ on their feet.

ENEMIES OF ASPIDIOTUS DESTRUCTOR.

*Aspidiotus destructor* has numerous enemies both external and internal or parastic. Of the former, Lacewing flies (*Chrysopa*) are the most important and do much good work, especially in Tahiti. Their long-stalked eggs are very numerous, but they suffer from the attacks of ants and also of an ichneumonid. Ladybird larvæ are also found upon scale in both groups, but are not so abundant as one would wish. In Tahiti much of the scale is to be found dead and covered with a black fungus, but I am uncertain whether this is primary or follows on the death of the scale from some other cause such as bacteria. Such dead scale has a sooty appearance and when seen under a microscope shows masses of mycelium and a few very simple spore cases. In some cases the ova turns brown and does not hatch and this may be the work of the same fungus or bacteria. I do think that this fungus is economically of great value as it was mostly present when the coconut palm was growing under somewhat unhealthy conditions.

In 1908 Doane visited Tahiti and the adjoining atoll Titiroa, and then reported some unknown agency as breaking open many scales during the night and removing the insect. I found evidence of the same agency at work not only at Tahiti but also at Ovalau in Fiji. Many efforts were made to try to find the cause and many insects came under suspicion at different times. I was eventually led to suspect the common earwig of the banana and experiments amply confirmed this suspicion. Later, on 24th February, 1921, I actually observed one of these earwigs in the field breaking open the full-grown scale and removing the contents. Sometimes one will find much of the half-grown scale on a leaf disappear and this puzzled me for a long while. At first I suspected the earwig for this also, but eventually observed an exceeeingly minute ant, perhaps two lines in length, working at and eventually succeed in lifting up one end of a parasitised male when he removed the contents and I captured him for identification. It seems to be a somewhat scarce species, and the only nests I was able to trace were

apparently in the wooden piles of dwelling-houses. On one occasion I saw one of the ants contend with a lacewing larva for a half-grown Mytilaspis scale, the ant finally retiring, when the lacewing quickly lifted the end of the scale and removed the contained insect.

PARASITIC ENEMIES.

When Doane visited Tahiti he discovered a very minute *Chalcid aspidiotiphague citrinus* (Craw) as parasitic on *Aspidiotus destructor.* It is a dull yellowish colour with brown striped abdomen and a number of brownish hairs on the thorax and plumose wings. All the specimens I examined were of the female sex. In its earlier stages the pupa is distinctly visible lying within the body of its host. It is easily found by the half circle of dark matter forming the excreta lying around the apex of the abdomen. This excreta seems to be held up within the body of the larva until just previous to pupation when it is discharged as a liquid mass and thus assumes its peculiar horseshoe shape. I have observed this discharge takes place when the larva was placed into the mountant for the microscope. There are apparently two forms of the pupa. A small dark one which is found in the second stage of either male or female scale and shows very little excreta. This form generally seems to emerge about the same time as the young larvæ appear. The other is somewhat large and is only found in adult female aspidiotus. This pupa is less plainly visible, but the antennæ are quite plain whilst the dark mass of excreta makes it very easy to find. This form did not generally emerge until 10 or 12 days after the young scale hatched out, but neither the resulting Chalcid nor the pupa showed any difference under the microscope except size from the smaller pupa of the second stage scale.

There seems much latitude in the time of ovipositing. Most that I observed took place when the scale was 14 or 15 days old, but I have seen a Chalcid apparently ovipositing in scale only 9 days old, whilst I have also observed attempts upon 21 or 22 days scale. These latter attacks all ended in the death of the scale from fungus. It is possible that this Chalcid also oviposits into the young larvæ when under their parental covering as I have observed them apparently attempting to do so. If this is the case it probably accounts for the small second stage forms and must take place very frequently.

When attacking 14–15 days *Aspidiotus* the Chalcid seemed to pass its ovipositor under the edge of the scale, but when attacking older specimens seemed to bore through at the point which formed the edge when its host was 15 days old. On my first visit to Tahiti I found a second Chalcid (*Aphelinus chrysomphali, mercet*) parasitic on *Aspidiotus* on some palms from Flint Island, and later on some young trees in Papeete about a mile away from the Flint Island ones. It is a larger insect of a clear canary yellow with bluish opalescent wings, which are studded with fine hairs. The pupa of this can be recognised within the scale not only by its more robust shape, but also by the eyes which first shew up red and subsequently turn black thus distinguishing them from citrinus in which it is the antennæ which are most visible. The excreta also is quite different, taking the form of small oval black lumps, which are deposited somewhat irregularly during the larvæ stage of the Chalcid at the apex of the abdomen, whilst the brownish larval skin can generally be observed lying beside the pupa. This Chalcid was very rapid in its movements and was difficult to watch. Imagos emerged on the second to the sixth day after the young scale had settled down and oviposition was observed on the seventh day scale. This

Chalcid is very important as it only attacks female scale and completely destroys them, whilst examples attacked by *citrinus* occasionally lay a few eggs. On my second visit I found this species had become far more abundant, and at Titiroa the two species were about equally abundant.

### SECONDARY PARASITISM.

Although prolonged search was made, and many thousands bred and examined no true secondary parasite was found. In the course of this search however a very interesting observation was made which seems to point to the origin of secondary parasitism. On the 19th February and again at a later date I observed a female of *citrinus* apparently ovipositing in a scale containing a pupa of *chrysomphali* and by the position of the body she seemed to pierce the body of the pupa. The result could not be observed because both instances occurred on cut leaves, but a large number were examined and on two or three occasions pupæ of *citrinus* were found in scale which contained a certain amount of excrement which appeared to belong to the larvæ of *chrysomphali*. There was some uncertainty in each case owing to the matting together of the scale, so that whilst not actually proved it seemed to show how secondary parasitism arose, and it is very interesting to find such taking place in the new association of species formed by *Aspidiotus destructor* and its two parasities, all of which are I believe recent introductions from different sources to the fauna of Tahiti.

To those who wish to study further into the structure of *Aspidiotus destructor*, I would refer to Green's monograph on the Coccidæ of Ceylon, whilst I am indebted to Dr. Guy Marshall, of the Imperial Bureau of Entomology, for kindly identifying the *Chalcididæ* for me.

### CULTURAL NOTES AND INCIDENCE OF PARASITISM.

On my first visit to Tahiti I found *Aspidiotus destructor* scarce and local, but with evidence of a comparatively recent much wider distribution. At this time diseased trees were only to be found on wind-swept coasts and small points which ran out into the sea, and such points undoubtedly acted as nurseries whence from time to time waves of disease swept across the island. Such a wave was passing on my second visit, but even then the disease seldom pentrated far inland, and as there was a considerable amount of undergrowth it was difficult to find disease amongst the younger trees. The same applied when the banana was grown amongst them. This may have been caused by such growth acting as shelter to such enemies of scale as lacewing fly and earwigs.

On the coral atolls planters had informed me that they had found it necessary to plant 50 per cent. closer together than usual or to leave the undergrowth as far as possible. This may have had something to do with the drying up of the shallow soil on such exposed places by sun and wind and thus weakening the tree. Of the two scale parasites *chrysomphali* seemed to be more tolerant of extreme heat and was found on the small exposed trees.

## REPORT ON THE SECOND MISSION TO TAHITI.

By H. W. Simmonds, Acting Government Entomologist.

Acting in accordance with instructions received I left Fiji on the 29th September, 1920, for Tahiti and arrived at Papeete on the 14th October. I found the country suffering severely from drought and everywhere the scale *Aspidiotus destructor* far more abundant than on my first visit. Immediately on my arrival I obtained a number of young nuts in kerosene tins and established nurseries at three places. Two of these were subsequently abandoned as unsuitable. In all 59 trees were started and of these 53 shipped away. The remaining six died. The continued drought hampered operations considerably and necessitated the carrying of water. Of the 53 palms, ten which were shipped by the yacht "Wisdom," are not expected to reach Fiji until some time in May. The first tree was shipped on the 13th November and although both Chalcids were present when despatched the Superintendent of Agriculture was only able to report the presence of *Aphelinus chrysomphali* on arrival, and this had been successfully introduced on my previous attempt.

Further shipments were forwarded on 25th December, 19th January and 4th February, and these were more successful, both Chalcids arriving safely. They were placed in the insectorium, where, on my return, I found both species breeding, *chrysomphali* however being still the more abundant.

On the 10th March by the courtesy of Captain Salisbury I was able to ship ten trees by the yacht "Wisdom" which was proceeding to Fiji without leaving the tropics.

I finally left Tahiti on the 15th March by the R.M.S. "Tahiti," bringing another 10 trees, and these arrived at Suva on the 6th April in good order, showing numbers of the small Chalcid *Aspidiotuphagus citrinus* (Craw.) On the same date three infected palms were forwarded to Levuka to be placed on Ovalau, both parasites being present in numbers. It is proposed to send a large consignment by the next boat. It is hoped to establish them in Ovalau and Moturiki, whence, when established, they can be transferred to the other islands where the scale exists.

### OTHER MATTERS OF ECONOMIC INTEREST.

The common banana of Tahiti is called the Rio. It is a tall species of a distinct sub-acid flavour and good colour, the bunches being however only a moderate size. As a table banana it is of very considerable value, and suckers were therefore obtained and forwarded by the Talune on the 25th December, 1920.

Tahiti has an orange of very high quality. It is a flat fruit, with a thin skin, exceedingly juicy and of excellent quality and texture, being quite free from any toughness. As all the plants in Tahiti are seedlings I forwarded a large number of seeds from selected fruit at various times for testing out here. I also brought back a specimen of the fruit, which I handed to the Acting Superintendent of Agriculture for examination. As this fruit is superior to any Californian orange I have met, and in view of the probability of reopening the citrus trade with New Zealand I would suggest that it might be possible to arrange with Raratonga to obtain the joint services of their orchard instructor to proceed to Tahiti during the season, and obtain wood from selected trees for grafting purposes. He would also be able to obtain grafts of some of the very high grade mangoes which are found on one or two estates there.

THE OVIRI NUT.

Further seed nuts of this variety were obtained and forwarded with the December consignment of palms. The results of investigations into the disease-resisting qualities of this nut will be awaited with interest.

Finally I would like to express my utmost thanks to Messrs. G. E. Sharood and C. Coppenrath who again rendered every assistance possible; to Dr. Williams for much assistance and advice; to Captain Salisbury of the yacht "Wisdom" for kindly consenting to transport a consignment; and to Mr. Harnett, Fruit Inspector of Auckland, and Messrs. Kirk and Campbell, of the Horticultural Division, Wellington, and others of that Department who at all times rendered the utmost assistance during the transfer of the trees through New Zealand.

## NOTES ON LEVUANA IRIDESCENS.

(*Beth Baker.*)

By H. W. Simmonds, Acting Government Entomologist.

During 1915–1916 the Government Entomologist, Mr. F. P. Jepson, made a series of investigations into the periodic appearance of this moth on coconuts in Vitilevu, in the course of which he showed that its appearance took a wavelike form, and that there were periods when in certain places it completely disappeared; although in another district it was present in unabated severity. During August and September, 1920, I commenced to follow up his work, finding the larvæ very abundant in the Nasese district.

At the time I found a few dead pupæ containing the fully-formed moth, the presence of such dead pupæ having been previously noted by the late Superintendent of Agriculture, Mr. C. H. Knowles, who suggested the possibility of fungoid or bacterial disease.

In September, 1920, we made enquiries as to the enemies of an allied moth, *Brachartona catoxantha*, in the Malay States, and were informed that, whilst Tachinid and Braconid parasites were always present, they considered a fungus, cultures of which they forwarded us, the most powerful agency in its destruction.

On my return from Tahiti in April, 1921, I found that the Nasese outbreak was quite past and not a living Levuana was to be found, but many dead pupæ were present, and as these showed signs of fungoid disease I handed several over to the Government Bacteriologist, Dr. Carment, who kindly made cultures from them, and at the same time from the pure cultures forwarded to us from Kuala Lumpur.

Dr. Carment's report is published below, and it is proposed to carry out experiments as to the liability of the larvæ to the cultures. Meanwhile further enquiries are being made as to the distribution of allied genera in the Austro-Malayan region in the hopes that we may eventually find a parasite which being mobile would be a more efficient agent in controlling this disease.

## FUNGUS DISEASE OF LEVUANA IRIDESCENS.

By Dr. A. G. CARMENT, Government Bacteriologist.

The Government Entomologist has supplied me with larvæ and pupæ of the above moth, some of which were recently dead, but the majority had died some time previously.

Stained microscopic sections of a selection of these showed mycelia and spores of a fungus ramifying throughout their tissues.

It is true that fungi might attack bodies after death as pointed out by Mr. Simmonds, so that conclusive proof could not be obtained until healthy larvæ and pupæ of this moth were inoculated with the fungus.

Experiments on this line can be carried out with local fungi and also the Malayan fungus as cultures are in readiness.

Points against infection after death occuring to me are:—

1. Colonies of larvæ and pupæ were infected with a fungus and life was extinct;
2. The position of the growing fungus in these specimens (ventral surface of the organism) is such as coincides with infection and destruction of the animal, and development of the fungus species which are known to attack and destroy caterpillars;
3. Cultures made from infected larvæ and pupæ produce abundant growth of mycelia and spores.

Mr. Simmonds is of opinion that there may be a fungus at work here as in Malay, and it is possible we may be able to enhance the destructive effect of local fungi.

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## REPORT ON RA.

By M. J. REIDY, Government Veterinary Officer.

Leaving Suva on the 18th I arrived at Ellington on the 19th of April. The holdings visited and the cattle and horses seen are given in order below:

*Mr. Barker's "Tovu."*—120,000 acres; cattle, 5,000; horses, 20.
*Messrs. Cotter and Sunderland.*—9,000 acres; cattle, 400; horses, 130.
*Yaqara Syndicate.*—14,000 acres; cattle, 3,000; horses, 250.
*Penang Sugar Estate.*—Under grazing, 2,000 acres; cattle, 100; horses and mules, 100.
*Roman Catholic Mission.*—1,000 acres; cattle, 50; horses, 5.
*Mr. Snow.*—1,000 acres; cattle, 40; horses, 6.
*Eighteen Fijian Villages.*—Cattle, 480; horses, 222.
*Indians.*—Horses, 200; cattle, 1,000.
*Grand total.*—10,000 cattle and 800 horses.

STALLIONS AND BULLS LICENSED IN RA.

Mr. Cotter—1 Clydesdale.
Sugar Company—1 Clydesdale.
Badri Maharaj—1 light draught.
Yaqara Syndicate—2 Clydesdales and 1 Suffolk Punch.

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Mr. Barker possesses 18 first-class Shorthorn imported bulls.

Mr. Cotter has a splendid imported Holstein bull, as well as some Fijian-bred cows of a first-class milking strain.

Mr. Clapcott goes in mostly for Herefords, with a few Shorthorns. He is now introducing into the herd half-bred Zebu bulls which he has recently acquired from Mr. Barker.

A number of half-bred Zebu cows were seen on Mr. Barker's estate. These were wonderfully docile, and in excellent condition, climatic conditions appearing to suit them admirably.

GRASSES.

*Trefoils.*—Trefoils of the large, medium and small varieties are found in the province of Ra, the large variety growing to a height of 18 inches from the ground, forming a good sward and making excellent grazing fodder.

*Para grass.*—Para grass is found on the river flats and valleys.

*Cocksfoot.*—A native Cocksfoot and an English Cocksfoot grow here to a height of three feet.

*Prairie grass.*—Prairie grass has been planted by Mr. Barker. It seeds twice in six months and the second cutting of this grass grows to a height of six feet.

*Paspalum.*—Paspalum is found in abundant quantities in Ra. The best general grass seems to be the large trefoil.

PASTORAL INDUSTRY.

The area of Ra under grazing by European settlers is about 150,000 acres and with the exception of a few basaltic ranges surrounding elevated plateaux on the mountain tops which are unsuitable for stock, the whole of this area is suitable for pastoral and cultivable purposes.

While part of the country is rough (20 to 30 acres) the major part consists of rich red-brown deep alluvial soil covered with good grasses and reeds. There are no poison plants, and almost all the herbage is edible. Springs abound on the plains, hillsides and even on the mountain tops. Permanent water lies throughout the year in the huge river-beds and tiny creeks. Although partially timbered practically no clearing is required for stock-raising. In places the trees are small and stunted, nevertheless in the province of Ra two forms of ant-resisting material for stockyards and fences are found. No. 1, a hardwood, has a lifetime of from 7 to 10 years as a post or stake; No. 2, vau or "sprouting wood," is everlasting, as it takes root and flourishes wherever driven into the ground. This material makes a superior post to either steel or galvanised iron—a permanent post that shelters stock from the sun in summer and the storm in winter.

Grass hay cannot be satisfactorily made as in England. The valleys and hillsides when seen by me at the end of the wet season resembled giant fields of green growing corn, and, in my opinion, the province of Ra is a wonderful stock-raising country. Wheat and potatoes have been grown there, but maize and rice are the principal crops grown. At present bacon and cheese are being manufactured; excellent butter for local consumption is churned daily in this fertile region. Were the necessary butter factories and cold storage facilities available I have no doubt with a denser European population settled on small farms that butter and dairy products of a quality second to none in the British Empire could be produced in the province of Ra. First-class herds for either milk or beef purposes can be raised or maintained at a minimum amount of cost to their owner. Steers scaling over 12 cwt. graze in the paddocks of Mr. Barker's estate. This is excellent for grass-fed cattle. When completely fenced this estate will have a carrying capacity of from 25,000 to 30,000 head of cattle.

A word of praise is due to Mr. George Barker for the scientific way he has laid out the paddocks, provided with patent self closing gates, and the 50 miles of four-barbed wire fences which are as straight as the roads in France.

In Ra the European-owned cattle and horses are in excellent condition, but the explanation is a very simple one, being due to climatic conditions. There are no long winter months of severe weather, frost and snow are unknown, rain falls during the hot or growing months resulting in the provision of natural pastures on a gigantic scale and a prolific growth of plant life of all kinds. The cane-growing possibilities of Ra do not come under my sphere of activity therefore I have not touched on it.

### DISEASE.

Ra is particularly free from disease or pests which kill off live stock or retard vegetation.

*Cattle ticks.*—Cattle ticks, the bane of both hot and temperate climes, are unknown.

*Tuberculosis.*—In the whole area of Ra only five animals were suspected, and on clinical examination three were found not to be affected, the other two were slaughtered and the diagnosis confirmed on *post mortem.*

### GENERAL MANAGEMENT.

General management amongst the Europeans leaves nothing to be desired, especially so in the case of Messrs. Barker, Cotter and White, all of whom are keen, capable and efficient. Unfortunately, the same cannot be said of Fijian and Indian methods as both nationalities make a practice of tethering stock on the village green. On the first occasion Indians' cattle were seen by me in this unhappy position it immediately struck me that they were some "fatted calves" being run in to celebrate the return of a prodigal, but great was my surprise on learning they were full-grown adult animals.

In the building of Indian houses in this district Edison-like genius is displayed in the prevention of air and daylight penetrating to the interior of the household. However, this is no business of mine, but it is my business to bring about the abolition of the tether rope and prevent anyone owning stock who is not in the possession of decent stabling byres, well-fenced paddocks with a plentiful supply of permanent water and grazing, as this will effectually prevent the breeding of underfed, interbred, stunted animals.

This leads me to suggest that an Ordinance be brought into force not to allow any Fijian or Indian to keep a stallion over the age of two years unless the animal has been licensed by a qualified veterinary officer. Detailed description of the said horse with identification marks, owner's name, address, and brand to be left with the District Commissioner of each particular province. Also that the existing Ordinance be amended to allow the licence of any particular stallion to be cancelled on the ground that stallions are subject to development of hereditary disease as they get into age. This disease they may be capable of passing on to their progeny (*e.g.*, cataract of eyeball).

### A SUGGESTION.

That some person or persons build a canning factory in Fiji, as the initial outlay for the building and up-keep of the business is small, while the profits accruing therefrom are likely to be great as there is an abundant supply of cheap cattle, and labour here is cheaper than in the Argentine or any of the great canning countries, besides the drainage due to the late war has seriously affected those countries. The energies of the factory need not be confined to meat alone as fruit (pineapple) and fish could be tinned by the same plant at different seasons of the year.

In conclusion I think it does not come within my particular sphere to write of the scenic beauty of the province of Ra, especially in the neighbourhood of the hills of Nanukuloa with its wonderful waterfalls and gorgeous-coloured canyon, neither may I write of the acres and acres of uninterrupted cane-fields as this particular and fascinating subject does not come under the category of stock-raising.

To the people of Ra I wish to tender my sincere thanks for their generosity and kindness to me.

## BUFFALO CROSS-BRED CATTLE.

By M. J. Reidy, Government Veterinary Officer.

Some of the inhabitants of Canada are making an effort to evolve a new animal, because Providence omitted to provide one which was adaptable for the necessities of the case. There are immense tracts of country in Canada which at present are of no economic account, nor is there, on the face of it, any prospect of their becoming other than what they are. You might turn buffalo on to them for Canadian foresight has saved the buffalo from extinction and it would not be difficult to breed it in ample numbers, but then the buffalo does not provide a beef that is marketable the world over. The domestic ox would not thrive in these vast inclement wastes. The steer would turn tail where the buffalo, protected by his shaggy front, would graze right into the blizzard. Consequently the Canadians have evolved an animal hardy enough to stand the blizzard and yet produce an acceptable brand of beef. This has been effected by crossing the buffalo with domestic cattle. At first half and half, of course, but now in various proportions so as to attain the best possible combination of a hardy habit with a succulent flesh. The experiment has proved a complete success mainly because unlike the mule the hybrids are themselves fertile.

## JAVA SHEEP OR GOAT.

By M. J. Reidy, Government Veterinary Officer.

Another hybrid animal is the Java sheep or goat. It first saw the light in Java, and gradually increasing in numbers it went forth to the Solomons and other Pacific Isles. It is a cross between the sheep and the goat, having the lop ears and long tail of the sheep. It never suffers from foot-rot and is constitutionally hardier and better able to withstand tropical conditions than the ordinary sheep. The flesh is very good to taste resembling the mutton of Welsh mountain sheep. In breeding these animals care must be taken to keep up a preponderance of the sheep.

## CANDLENUTS AND CANDLENUT OIL.

By C. H. Wright, M.A., F.I.C., Government Chemist.

It is well known that linseed oil when exposed to air thickens and "dries," and when spread out in a thin layer it hardens forming a solid elastic film. It is this property that makes linseed oil such a valuable vehicle for pigments in paints; for the same reason it is also largely used in making putty and linoleum. This property of "drying" on exposure to air is possessed by other oils which are known as "drying" oils, and is due to absorption of oxygen from the air. In examining an oil to find out if it is a "drying oil" it is not usual to determine the oxygen absorbed, but another property closely connected with it, viz., the absorption of iodine. If an oil dissolved in an oil solvent is treated with iodine under certain conditions it absorbs iodine, and the percentage of iodine absorbed by the oil is known as the Iodine Value. This is a measure of the tendency of the oil to "dry" on exposure to air; thus, linseed oil has an iodine value varying between 175 and 200; cottonseed oil, a "semi-drying" oil, has an iodine value of about 110; whilst the iodine value of coconut oil, a "non-drying" oil, is about

Linseed is obtained from Argentina, United States, India and Canada. Before the war large quantities of linseed were obtained from Russia, which amounted for the five years ending 1912 to 23·7 per cent. of the total production (Fryer and Weston, *Oils, Fats and Waxes*, Vol. 1, 1918, p. 116). Since the collapse of Russia this supply of linseed has been cut off, and there has resulted a world shortage of linseed oil, and a great increase in the price of this oil. In consequence linseed oil is now extensively adulterated with cheaper oils, and a great deal of paint is now made with other cheaper and inferior oils in place of linseed oil. But as many of these oils have iodine values less than linseed oil the paint will not dry and remains in a sticky state.

Efforts are now being made to find a substitute for linseed oil, and it is obvious from what has been explained above that such an oil must have a high iodine value, approaching as nearly as possible to that of linseed oil. One of the most promising substitutues so far proposed is the oil of the candlenut, *Aleurites moluccana*, a tree widely distributed throughout the Malay Archipelago and Polynesia, which is well known in Fiji as *lauci* or *tuitui*. The seeds of this tree contain a good deal of oil, and, before the arrival of Europeans were used in Fiji and Polynesia as an illuminant. The seeds from which the shell had been removed were strung together on the midrib of a coconut leaflet or a strip of bamboo; the upper kernel was ignited and as the flame travelled downwards the burnt black kernels were knocked off (see W. W. Gill, *Jottings from the Pacific*, 1885, p. 192). This explains the origin of the Fijian name *tuitui*, which means strung together (compare *tui ika*, a string of fish). In this connection it is of interest to notice that the native name of the candlenut in Futuna, Tonga and the Hervey Islands is *tuitui*; in Tahiti it is *tutui*; and in Hawaii *kukui* (which is the same word, since the Hawaiian k is equivalent to the Tongan and Fijian t). The similarity of the native names shows that the candlenut is one of the many economic plants distributed by man; but though highly valued as an illuminant by the Polynesians, and for this reason carried about from island to island in the Pacific Ocean, it is only recently that it has been utilised on a large scale.

In the Philippine Islands the production of candlenut oil for export is quite an important industry (see *Bulletin of the Imperial Institute*, 1919, XVII, p. 591). In the Philippine Islands there are two species of *Aleurites*, but of these *Aleurites moluccana* is more widely distributed, and is the source of the commercial oil, there called lumbang oil. For a long time its manufacture has been carried out in a crude way, but now some of the large coconut factories are paying attention to lumbang oil. Not only are the candlenuts collected from trees growing wild, but about half a million trees a year are being planted, so that an increasing supply of nuts is assured. Lumbang oil is used locally for paints and for making soft soap, whilst the demand for this oil in the United States exceeds the present supplies.

There seems no valid reason why a similar industry should not be established in Fiji. I am aware that small consignments of candlenuts have been exported from Fiji in recent years, and John Horne (*A Year in Fiji*, London, 1881, p. 190) states that during 1875 the value of the candlenuts exported was £65; in 1876, £1,562 9s.; in 1877, £3,040; and in 1878, £3,545. "The value on the spot, in 1877, was a little over £10 per ton." Since then prices have changed considerably; whilst costs of labour in Fiji and freights have increased, so also has the price of linseed oil on which the price of candlenut oil depends, and it is believed that the enhanced cost of the latter would leave a considerable margin of profit to anyone who would now undertake the export of candlenuts. Recently a sample of candlenuts

from the Cook Islands was sent to the Imperial Institute and a report on these is given in the *Bulletin of the Imperial Institute*, 1920, XVIII, p. 25. In the hopes of making some use of the candlenuts at present going to waste in Fiji, and thus developing our own natural resources; and with the object of helping anybody who is at present interested in the question, the above report is summarised below.

The nuts consisted of 68 per cent. of shell, and 32 per cent. of kernel. The sound kernels contained 4·5 per cent. of moisture and yielded 63·7 per cent. of a pale yellow oil. This oil had an iodine value of 158·5, thus agreeing with previously recorded values. It was found that the untreated oil dried very slowly, but gave better results after being heated. The purgative properties of the oil prevent the residual cake being used as a cattle food, and it is only saleable at a low price as a manure. In the United Kingdom candlenuts have not become a regular article of commerce and the oil is not well known on the market, but in the United States candlenut oil meets with a ready demand. "There is no reason to doubt that both the oil and the kernels would sell readily in the United Kingdom at the present time if fairly large and regular supplies were offered at suitable prices. It would most likely be unprofitable to ship the entire nuts, as they only contain about 20 per cent. of oil, and even with the prices now ruling for oils the high freight rates would render the export of nuts unremunerative. The kernels might, however, be shipped, and should realise about £40 to £44 per ton in the United Kingdom with linseed at £54 per ton."

"The chief difficulty in the exploitation of candlenuts is that of shelling the nuts. The shells are hard, whilst the kernels are rather brittle and tend to cling to the shell, so that although it is not difficult to crack the shells it is difficult to avoid breaking the kernels into small pieces, which often adhere to portions of the broken shells." In the Philippine Islands various methods are employed, which are given in the *Bulletin* referred to above, but the method which seems the most likely to prove generally useful is as follows:—"The nuts are dried by exposure to the sun for several days, and then cracked by hand with a hammer or stone, the kernels being picked out by hand with the help of a knife. By this method kernels of good quality are obtained, but the process is tedious and is only possible when cheap labour is available. The kernels broken in this operation should not be included with the whole kernels for shipment, as they would deteriorate in transit and lower the value of the consignment."

"When treated by this method at the Imperial Institute an average sample of the Cook Island nuts yielded about 20 per cent. by weight of whole kernels in good condition, and 5 per cent. of broken kernels in fair-sized pieces, which in actual practice could be shipped separately and sold at a lower price than the whole kernels."

Other methods of shelling the nuts employed in the Philippine Islands are as follows:—

(*a*) the nuts are placed on the ground and covered with straw, which is then burnt; the nuts are then sprinkled with water and burst;

(*b*) the nuts are placed in boiling water for five or six hours; this loosens the kernel, and the nuts are then cracked;

(*c*) the nuts are heated in an oven for three or four hours and then placed in cold water where they are left over night when the shells burst.

The two latter methods were tried at the Imperial Institute, but not with any great success. It is probable, however, they might be more successful with the freshly gathered nuts than with nuts which have been kept for some time, and they are certainly worth trying here.

## REPORTS ON RECENT WORK AT THE CHEMICAL LABORATORY.

By C. H. WRIGHT, M.A., F.I.C., Government Chemist.

### RICE HUSKS.

During February and March three samples of rice husks from the Rice Mill, Suva, were received for analysis. These contained in parts per 100:—

| | *No.* 1. | *No.* 2. | *No.* 3. |
|---|---|---|---|
| Water | 11·97 | 12·60 | 10·96 |
| Protein | 6·59 | 6·81 | 5·75 |
| Oil | 4·21 | 4·46 | 5.20 |
| Carbohydrates | 43·46 | 44·28 | 38·73 |
| Fibre | 22·70 | 21·36 | 26·82 |
| Ash | 11·07 | 10·49 | 12·54 |
| | 100·00 | 100·00 | 100·00 |

In *The Agricultural Ledger*, 1903, No. 7, are given the analyses of eight samples of Indian paddy husks. These analyses are summarised below:—

| | *Average.* | *Maximum.* | *Minimum.* |
|---|---|---|---|
| Water | 8·58 | 9·59 | 6·73 |
| Protein | 3·85 | 4·82 | 2·32 |
| Oil | 2·54 | 5·43 | 1·24 |
| Carbohydrates | 34·76 | 40·95 | 29·56 |
| Fibre | 29·24 | 40·58 | 22·14 |
| Ash | 21·03 | 26·48 | 16·42 |
| | 100·00 | | |

Sample No. 3 above agrees most closely in composition with the Indian paddy husks. It will be noticed that samples 1 and 2 contain more carbohydrates and less fibre than No. 3. This is because the two former samples contained a good deal of broken rice together with 1·5 and 3·1 per cent. respectively of paddy rice. Sample No. 3 was taken subsequently and contained no paddy rice.

The above rice husks are useless as a feeding stuff owing to the contained rice hulls or rice shudes (*i.e.*, the outer layer of the paddy rice). These are hard and gritty, and when fed to cattle are very injurious, causing irritation to the walls of the stomach and intestines resulting in vomiting and in some cases death.

### PADDY RICE.

It will be noticed that the three rice husks from the Rice Mill contain more water than the Indian paddy husks. To find out if Fiji paddy rice contains more water than Indian paddy rice the water was determined in six samples of paddy rice from the Rice Mill with the following results:—

| | |
|---|---|
| Mootmoori paddy | 13·10 per cent. |
| Patna paddy | 13·52 ,, |
| Black paddy | 12·14 ,, |
| Table paddy | 12·43 ,, |
| From No. 1 bin | 13·78 ,, |
| From No. 2 bin | 12·86 ,, |
| Average | 12·97 ,, |

In eight analyses of Indian paddy rice given in *The Agricultural Ledger*, 1903, No. 7, the percentages of water vary from 11·72 to 12·92 with an average of 12·68. Also in six analyses of paddy rice made in British Guiana (*West Indian Bulletin*, XX, 1912, p. 574) the percentages of water vary from 11·7 to 13·6 with an average of 12·6.

Hence the above samples of rice from the Rice Mill do not contain an excessive quantity of water.

MAIZE.

Complaints have been received from time to time with regard to the maize shipped from Fiji to New Zealand. On arrival there it has been found to be infested with the weevil and the maize moth. It is known that the more water maize contains the more liable it is to insect attack, and it was therefore thought that the maize exported to New Zealand might contain an excessive quantity of water. To find out if this were so, samples of exported maize were obtained from the Inspector of Produce, Suva. Five such samples have been examined and were found to contain the following percentages of water:—12·51, 13·84, 10·51, 14·78 and 13·09; average, 12·95.

Henry and Morrison, *Feeds and Feeding*, 17th edition, 1917, p. 151, state that maize is graded in the United States according to the percentage of water it contains. Thus the percentage of water must not exceed 14 per cent. for grade 1, 15·5 per cent. for grade 2, 17·5 per cent. for grade 3, and so on. From the above results it will be seen that only one sample contains more than 14 per cent. of water. This would therefore be classed as grade 2, whilst the other four samples would be classed as grade 1.

Henry and Morrison, *loc. cit.*, also state that in the Southern States "the husks are left on the ears because of the weevil, a beetle that lives in the kernels unless they are protected. Shelled corn does not keep well in bulk, especially in summer, and so corn is held in ear form as long as possible." It would therefore appear to be advisable in Fiji to keep maize in the ear as long as possible and not to remove the husks (*i.e.*, the spathe-leaves surrounding the cob); and it is probable that the prevalence of the weevil and the moth in Fiji maize is due to the neglect of these precautions rather than to an excessive quantity of water in the maize.

COPRA.

In Pamphlet No. 30 the effect of moulds on copra in decomposing the contained oil with the consequent production of free fatty acids was explained. It was also explained that moulds grow best when the copra contains from 10 to 15 per cent. of moisture, and that if the moisture is reduced to 6 per cent. or under, the conditions are no longer favourable for the growth of moulds, and the decomposition of the oil is thus prevented.

When copra is kept moist and allowed to go mouldy, or on the large scale when copra containing an excessive quantity of water is stored, other changes take place, one of which is the evolution of carbon dioxide. This is the gas which caused the death of three men at Levuka on 1st September, 1919, when Captain Twentyman, then Harbour Master at Levuka, and Jonitani Rabukawaqa succeeded in rescuing the Captain of the American schooner "King Cyrus" who was overcome by this gas in the forepeak of the vessel, and they too almost lost their lives in doing so. The evolution of carbon dioxide under such conditions has been proved in the Laboratory; it is accompanied by a loss in weight of the copra, and changes in the composition of the copra which are at present being investigated.

In connection with this work analyses of copras are being made. Below I give the analyses of a copra from Devo Estate prepared in a dryer (No. 1) and a sample of average Fiji copra (No. 2):—

| | *No.* 1. | *No.* 2. |
|---|---|---|
| Water | 5·88 | 7·02 |
| Oil | 64·84 | 64·68 |
| Protein | 7·31 | 8·31 |
| Carbohydrates | 17·31 | 15·66 |
| Fibre | 3·06 | 2·35 |
| Ash | 1·60 | 1·98 |
| | 100·00 | 100·00 |

I thank Mr. J. H. Millet and the Hon. J. M. Hedstrom for kindly supplying these samples of copra.

## THE DWARF COCONUT.

The following note, extracted from an article on "The Dwarf Coconut," by Mr. W. P. Handover in the *Agricultural Bulletin of the Federated Malay States* will doubtless be interesting to our readers. In reference to this topic the *Fiji Times* recalls that in 1885 a most exhaustive history of the coconut palm was published by the proprietors of the *Ceylon Observer*, and issued under the title "All about the Coconut Palm." In this book many varieties of the palm are mentioned, but the Dwarf Palm mentioned therein is described as bearing a sort of Maldive or dwarf coconut about the size of a duck's egg. However that may be, the article alluded to reads as follows:

"The dwarf coconut, known in this country as 'nyiur gading,' is remarkable for its early fruiting, palms only 10 feet high bearing abundant fruits touching the ground. The young palm grown under good conditions starts to flower in its third year and produces ripe fruit about nine months from the appearance of the flower-spike. The initial flower-spikes contain only male flowers, but other spikes appearing in rapid succession are larger and bear an increasing number of female flowers also, a spike from a six-year-old tree being counted with 200 young female flowers, whilst trusses of fruit from similar trees have been found with as many as fifty-five ripe nuts. It is generally of a bright yellow colour, and Winstedt, in his quotations from Malayan Folk Lore speaks of 'nyiur gading,' the golden coconut only to be found in the Princes' Gardens.

"Five hundred nuts to a picul (133 1-3 lb) copra is a general average yield. With the leaf length only 12 feet, it was found convenient to plant the palms 24 ft. by 20 ft., which gave ninety to the acre, a number nearly double to that required when planting big palms. In the fifth year the trees yielded thirty nuts apiece, so that 2,700 nuts would be obtained from trees planted ninety to the acre, while in the ninth year, which is the sixth yielding year, 120 nuts were yielded per tree in full bearing, making 10,800 nuts per acre, or 21 3-5th piculs (2,807 lb) copra per acre. The trees would probably yield 40 nuts apiece or 1,800 nuts per acre, giving 8 piculs of copra per acre. The nuts of the dwarf trees can be easily and rapidly picked and also inspected for beetles and other pests. Almost two-and-a-half times the number of nuts per picul of copra have to be handled as compared with the larger nuts, but is is suggested that this may not be of great consequence when, working with newly-devised methods and machinery, dealing with large quantities."

[A good coconut tree should yield an average of 100 nuts per year, and in good seasons 200 nuts have been obtained, but the average in some West Indian islands is about 65 nuts per tree. Coconut palms will continue to

bear for seventy or eighty years. The low average is due, doubtless, to want of care and attention on the part of the planter. In 1908 the average return per tree in Papua was given by Mr. N. R. Schroder, in an article contributed to *Dalgety's Review*, at the low estimate of 60 nuts per tree, and during the first six years little or no returns were to be expected.—Editor, Q.A.J.]

## SELECTION OF SEED MAIZE.

The following rules for selection of seed maize in the field and in the barn are recommended by the Department of Agriculture, New South Wales, and their adoption here is desirable:—

### TEN RULES FOR SELECTION IN THE FIELD.

1. Select plants which produce good ears under normal or adverse conditions of space, &c., in the field.
2. On poor ground select all ears from suckerless stalks, and on rich soil those, if possible, which bear ears on the suckers.
3. Do not select for two or more ears per stalk unless the first ear is up to standard.
4. Select ears which are of comparatively medium height on the stalk—neither too high nor too low.
5. Select only those ears which are well protected by the husk.
6. Avoid short-shanked ears, and also a shank which is too thin or excessively thick.
7. Select only those ears which droop at maturity.
8. Avoid thin-stalked plants, and those which taper too rapidly to the ear.
9. Select those plants which produce a large ear to a limited growth of stalk.
10. Select ears from high-yielding rows in an ear-row test.

### TEN RULES FOR SELECTION IN THE BARN.

1. Select ears which are heavy in proportion to their size when dry.
2. Select ears which are cylindrical in shape or nearly so, and avoid very tapering ears.
3. Select ears with straight rows, regular from butt to tip.
4. Select ears with well-rounded and well-filled butts and tips.
5. Avoid ears with large spaces between rows or grain.
6. Do not strive too much after small cores—a larger core carries more grain.
7. Grain should be of uniform wedge shape, full tipped and thick.
8. A rough dent is usually indicative of deep grain.
9. Yellow ears should have a red core, while white ears should have a white core; the grain should be of uniform bright colour.
10. The grain should be in good condition and well matured—dry, sound and firm on the cob.

—*New South Wales Agriculture Gazette.*

## PRESERVING SMALL LOTS OF GRAINS FOR SEED PURPOSES.

It is well known that unless special provision has been made in the way of air-tight tanks, fumigation, &c., it is a most difficult matter, on the coast, to keep seeds such as cowpea, grain, sorghums, maize, &c., free from weevils.

It has been found that weevils cannot multiply in grain unless it contains a certain percentage of moisture. In wheat, for instance, there has to be at least 10 per cent. present. When harvesting it invariably contains from 6 per 7 to cent. moisture, and is therefore weevil-proof.

A simple method of keeping the moisture content under weevil requirements is to use a vessel or container as air-tight as possible, such as a tank, petrol tin, old cream can, &c., and when storing seeds to include a quantity of freshly burned lime. In the event of the container not being insect-proof, the bags containing the seeds should be covered right over with the lime. In fact, the lime can be mixed with the grain without a detriment. In order to ascertain whether lime would be injurious to vitality, a number of maize cobs and grain sorghum heads were buried in partly air-slaked lime in the month of June. A vitality test was carried out in September, the maize giving 100 per cent. and the sorghum 98 per cent. germination. A further test was made at the end of December with practically similar results.

The cost of the lime used in the preservation of perishable products would be almost nil, as it can afterwards be applied to the land with, in most instances, considerable advantage.—*Journal of the Jamaica Agricultural Society.*

## COTTON SEED MEAL.

Cotton-seed meal is one of the richest and most valuable cattle food-stuffs. Its food value exceeds that of maize meal by 62 per cent., and wheat meal by 67 per cent.

The following is an average analysis of samples of cotton-seed meal:—

| | |
|---|---|
| Water | 7·80 |
| Fat | 9·31 |
| Protein (albuminoids, &c.) | 42·00 |
| Nitrogen free extract (carbohydrates, &c.) | 27·83 |
| Fibre | 7·18 |
| Ash | 5·88 |

Cotton-seed is also a valuable manure, chiefly on account of its richness in nitrogen, but it is far more economical to feed it to cattle, when 80 per cent. of its manurial value is recovered in the dung.

### FEEDING VALUE OF COTTON SEED PRODUCTS.

Under this a large amount of information has been brought together on the results of feeding experiments with cotton-seed produced in the United States and in England.

"Raw cotton-seed cannot be successfully fed to animals, as the lint and dust render it injurious, and it is too rich. It appears to be especially injurious to pigs." So wrote Professor J. P. d'Albuquerque, of the United States Department of Agriculture in 1896.

Experiments in Queensland have not borne out this condemnation of raw cotton-seed as a stock food.

Cotton-seed meal mixed with hulls is employed in enormous quantities in the United States in the fattening of cattle, and can be fed to cattle, sheep, horses, mules, and poultry. As an instance of the kind of results obtained

at Woburn, England, it was found that, with fattening bullocks, a mixture of equal parts of cotton-seed cake (cotton-seed meal) and maize meal produced a larger increase in live weight and at less cost than linseed cake.

There can be no doubt that cotton-seed meal, mixed with molasses, and fed in addition to the usual green fodders, would form a valuable aid in rendering sugar plantations self-supporting.

Cotton is a crop well worth growing, seeing that it supplies not only marketable commodities—namely, cotton fibre and cotton-seed oil, for which there exists an enormous demand—but also residues of considerable value as cattle foodstuffs.—*Queensland Agricultural Journal.*

## WEEDS AS PESTS, AND THEIR SUPPRESSION.

That weeds prove injurious in more than one direction has become common knowledge, and the necessity for their suppression is realised.

Previously it was thought that weeds were of little importance as specific pests to agriculture and to the stockman (using these words in the broadest sense), as was also the case in regard to navigation. Practical experience, however, has proved this notion to be wrong. To-day, all parties interested should be on the lookout and guard against the introduction and spread of weeds, for it has become quite evident that the losses accruing from rank weed growth can be, in many instances, if not greater, just as great as those brought about by insects, fungi and other agents.

In spite of these facts, however, very often there is a tendency to neglect a weed on its first appearance, until its spread has become alarming. It is thought that this arises from the fact that the work of weeds is less visible than that of insects, &c., and therefore is more difficult of demonstration; that the presence of vegetation is inevitable, and the line of demarcation between noxious weeds and wild plants is indistinct; and that new weeds are not recognised until their spread becomes severe, and any means of checking them costly or impractical. An excellent illustration of such a tendency is given in the *Monthly Bulletin of the Department of Agriculture*, California, October-November, 1920, in the spread of the Russian thistle in that State. It is stated that when first observed in the Antelope Valley, where it had already occupied a large area, vigorous action, followed by persistent watchfulness to avoid new infestations, might have freed the State of this pest; but in spite of warnings from various authoritative sources, the weed was allowed to spread until now it covers the southern half of California, and a large area of the northern part.

Weeds are injurious to agriculture from the points of view of robbing the soil of moisture and plant food; of overcrowding crops and increasing the cost of operations; and of reducing the final values of crops. A good example of these was given in an article published in the *Agricultural News* for April 17, 1920, dealing with an experiment conducted in Hawaii with regard to weed control and fertilization. It was shown that the application of fertilizers without weed control, as compared with weed control and no fertilizers, produced no greater gains; weed growth and no fertilizer proved very deleterious as compared to weed control and no fertilizers.

Investigations have shown that weeds growing around fruit trees have a very deleterious effect, in some instances even bringing about the deaths of the trees. These ill effects are due to toxic root poisoning (see *Agricultural News*, Vol. XX, p. 57). No doubt this is also the case in regard to forest trees.

To the stockman great losses have accrued by the rapid spread of weeds. His grazing lands gradually deteriorate under the growth of plants of inferior forage value. The vitality of animals feeding on unnutritious foods is gradually lowered. This lowering in vitality may be so slight that the ill-effects may not be observed until it is too late. On the other hand, stock may be killed outright by eating poisonous weeds. In the case of sheep, very often the market value of their wool is lowered, owing to the presence of burrs, for instance.

With regard to weeds proving a pest to navigation, the reader is referred to an article published in an earlier issue of this Journal (January 22, 1921), on the water hyacinth (*Eichornia crassipes*), which, it is stated, has become a serious menace to navigation in the rivers of Florida. It has become so abundant in Florida, Louisiana and Texas as to obstruct navigation in the waters emptying into the Gulf of Mexico. Attempts to eradicate this pest have cost the United States Government millions of dollars, but it would appear that, so far, no thoroughly effective method has been discovered which will completely remove the weed at a reasonable cost. Not only, however, has this pest interfered with navigation, but it is said to have caused great loss in the value of timber floated down the St. John's River. In such instances, the rank decaying vegetation also becomes a menace to sanitation, forming a shelter and breeding place for insect pests, as well as interfering with sewage disposal.

As already mentioned, the necessity for weed suppression is quite apparent. There should be thorough co-operation among all those affected, in order to prevent the introduction of new weed pests and to guard against the spread of such as are already established. In discussing the present needs of the California State Department of Agriculture in weed control work in that State, the bulletin above referred to suggests that there should be a pure seed law, a sufficient fund to undertake the proper study of the existing weed situation, and an effective law empowering the centralized direction of weed control.—*Agricultural News.*

## PAPER FROM VAU STEMS.

"Vau" is the Fiji name for *Hibiscus tiliaceus*, Linn, a small tree or bush, widely distributed in the tropics. The stems yield a bast fibre of fair quality, which is used in India for making ropes. The wood, sometimes known as "cork wood," is employed in some of the Pacific Islands for making boats; in India it is used mainly for fuel, and occasionally for hut building. Pieces of the young stems from Fiji, 12 inches in length and consisting of fibrous bark enclosing a soft wood, have been investigated as a paper-making material. They had the following composition:—

| | |
|---|---|
| Moisture | 9·3 per cent. |
| Ash | 1·8 ,, |
| Cellulose in material as received | 45·2 ,, |
| Cellulose expressed on dry material | 49·9 ,, |

Length of ultimate fibres—from 0·8 to 1·6 mm.
Average—1·2 mm.

On treatment with caustic soda under conditions similar to those employed on a commercial scale in the preparation of paper pulp the following results were obtained:—

| Experiment. | Caustic Soda used. | | Conditions of Boiling. | | Parts of caustic soda consumed per 100 parts of stems. | Yield of dry pulp expressed on stems as received. |
|---|---|---|---|---|---|---|
| | Parts per 100 parts of stems. | Parts per 100 parts of solution. | Tinte. | Temperature | | |
| A .. .. | 16 | 3 | 7 | 140°C | 11·1 | 54 |
| B* .. .. | 16 | 2·5 | 5 | 160°C | 12·4 | 46 |
| C .. .. | 22 | 4 | 6 | 160°C | 13·2 | 36 |

* In this experiment the bark was removed from the stems and the wood only employed.

When boiled under the usual conditions, *i.e.*, with a low percentage of caustic soda, the stems gave a good yield of pulp, which, however, did not break up completely and could not be bleached. The removal of the bark before the preparation of the pulp in experiment B did not appear to make any appreciable difference to the pulp obtained.

A better product was obtained on treating the stems under the more drastic conditions of experiment C, but even in this case the pulp did not beat very well, and could only be bleached to a cream colour.

The average length of the ultimate fibres (1·2 mm) is rather short, and the pulp is consequently of somewhat poor quality.

The stems give a good yield of pulp when subjected to mild treatment with caustic soda, but the quality of the pulp is rather inferior. The stems could not be profitably exported in the raw condition, and it is probable that if they were converted into the pulp in Fiji the pulp would not be of sufficient value for export, although it would be suitable for the manufacture of wrapping paper for local use.

## COUNCIL OF PLANTERS OF FIJI.

### GENERAL MEETING.

A general meeting of the Council of Planters of Fiji was held in their offices, Central Chambers, Suva, commencing on Monday morning, 18th April, 1921, and following days.

The chair was occupied by the Vice-President, Mr. E. Duncan, in the temporary absence of the President, Mr. J. L. Hunt, and among those present were the Hons. H. V. Tarte, M.L.C., J. M. Borron and F. C. Clapcott, M.L.C., and Messrs. W. P. Lyons, R. Bentley D. McKenzie, J. J. Barker, A. H. Witherow, W. H. Johnson, Jos. Harper, J. Cotter, W. Beddoes, E. F. Powell and A. E. S. Keely (Secretary).

### *The Malay Code.*

On the motion of the Hon. Mr. Tarte, seconded by Mr. Witherow, it was unanimously resolved, "That in the opinion of this Council a deputation, consisting of the Chairman, Secretary and Mr. Powell wait upon His Excellency

the Governor and urge him to take immediate steps to have an Immigration Council formed on the general lines of the Malay Code, but which would control all employers and coloured labourers in the Colony."

The resolution was supported by the Chairman, Mr. Witherow and other members.

*Proposed Importation of Chinese.*

The whole question of introducing Chinese labour was freely discussed in all its bearings by members present, and a resolution unanimously adopted, authorising the Chairman to enter into negotiations with China in connection with the importation of labour on conditions approximating to those obtaining in Malay.

The Hon. Mr. Tarte, the Chairman and Messrs. Lyons, Witherow, Powell, Barker and others spoke in favour of the resolution.

*Export Tax on Copra.*

It was unanimously resolved on the motion of the Hon. Mr. Tarte, seconded by Mr. Coubrough, "That in view of the prices current for copra the export tax on copra be temporarily removed until such time as the local price exceeds £20 per ton."

The Chairman, Messrs. Witherow, Lyons and Barker spoke in favour of the resolution.

*Appointment of Government Entomologist.*

On the motion of the Hon. Mr. Tarte, seconded by Mr. Lyons, it was unanimously resolved, "That in the opinion of this Council it is the duty of the Government to take immediate steps to obtain the services of Dr. Illingworth, and that the Chairman, Messrs. Barker and Witherow wait upon His Excellency and inform him accordingly."

The opinion generally expressed by members was that the acting Entomologist was a very valuable officer and in the event of Dr. Illingworth being appointed, Mr. Simmonds' services should be retained.

The Chairman, Messrs. Witherow and Barker spoke in favour of the resolution.

*Subsidised Steamships.*

This subject was discussed, but it was decided that the matter should, for the present, remain in abeyance.

*Destruction of Government House by Fire.*

The Chairman was requested by the meeting to write His Excellency conveying the sympathy of the Council in connection with the recent fire at Government House.

*Paper Pulp Production.*

The Hon. Mr. Tarte stated that he had been informed that the machinery for the treatment of paper pulp at Savusavu was expected to arrive in July, and would be installed and operated by Mr. Dyer's Company.

*The Cultivation of Cassava.*

Discussion took place on this subject and was participated in by the Hon. Mr. Tarte, and Messrs. Powell, Witherow, Coubrough, Barker, Lyons, Hunt (President) and the Chairman.

Mr. Jerome Dyer, O.B.E., attended the meeting on the following day, and explained the proposals of his Company in connection with the establishment of power-alcohol distilleries in Fiji which were nearing completion. He was accorded a vote of thanks for his address.

*The Fiji Committee.*

Mr. Jerome Dyer informed members that on his return to London he proposed co-operating with Mr. G. Berkeley, the organiser in the formation of the Fiji Committee, based on the lines of the West India Committee.

The project had the cordial support of the members of the Council of Planters.

*Cattle Tick.*

It was unanimously resolved that the Chairman should communicate with the Government and impress upon them the urgency of the following facts:—

(1) that cattle introduced to the Colony must come from a clean area, and be certified accordingly;
(2) that as tick exists in New Zealand, the present Ordinance be extended to that Dominion;
(3) that immediate precautions be taken with respect to the importation of stock from New Zealand by means of dipping and quarantining on arrival;
(4) that a quarantine area be provided upon an island equipped with proper dips;
(5) that the island of Namuka appears to be suitable for quarantine purposes.

The Hon. Mr. Tarte, the Chairman, Mr. Coubrough and others spoke to the resolution.

*Fire Blight.*

It was unanimously resolved on the motion of Mr. Powell, "That steps be taken to stop the importation of all fruit and plants from New Zealand on account of the existence of Fire Blight in the Dominion."

*Complaint re Native Official.*

A letter was read from a settler complaining of certain treatment received at the hands of a Buli in connection with certain building operations.

It was resolved that a reply be forwarded stating that as the communication contained only one side of the question, the writer should lay a specific charge and forward it through the District Commissioner, and a copy of same to the Council of Planters, who would then support it to the fullest extent possible.

*Preference to Returned Soldiers.*

A letter was received from Colonel Hall requesting the planters to offer any vacant positions preferably to returned soldiers.

*Reports on Indian Labour.*

Copies of reports from the Colonial Sugar Refining Company re Indian labour in Ceylon were made available for the perusal of members.

The proceedings closed with a vote of thanks to the Chairman.

## EXTRACTS FROM REPORTS OF INSPECTORS.

INSPECTION OF PRODUCE.

The Inspector of Produce reports the following particulars for the three months from 1st February to 30th April, 1921:—

*Bananas Exported.*—To Australia: Bunches, 40,184; cases, 12,960; equivalent to 66,104 bunches; to New Zealand: Bunches, 7,527; cases,

57,172; equivalent to 121,871 bunches; totals: Bunches, 47,711; cases, 70,132; equivalent to 187,975 bunches.

*Other Produce.*—To New Zealand: Peanuts, 80 sacks; kumalas, 120 sacks; Mandarins, 707 cases (condemned in New Zealand); to Australia: Rubber, 7 tons; coconuts, 95 sacks; to Honolulu: Tongan bark, 37 sacks.

*Plant or Matter.*—For Australia, 8 packages fumigated; from Australia, 548 packages fumigated; for New Zealand, 7 packages fumigated; from New Zealand, 111 packages fumigated; 17 destroyed; for Tonga and Samoa, 61 packages fumigated; from Tonga and Samoa, 149 packages fumigated.

*Vessels to and from outlying islands.*—Inspected, 8 vessels; matter destroyed, 6; matter fumigated, 39 packages.

*Inspection of seeds, &c., at Post Office.*—Number of visits, 7; 43 packages inspected and passed; 7 fumigated.

*Cash to Treasury.*—Total amount for three months for fumigation fees, £14 0. 7.

## REPORTS FROM INSPECTOR FORSYTH.

### JANUARY.

*Inspection of vessels.*—During the month 39 vessels were inspected and material was destroyed in eight cases. Quite a number of cutters are now trading direct to Savusavu from the various islands, hence the decrease in number inspected. One case was dealt with for breach of regulations, and the master of the vessel fined £3. Others have succeeded in evading the service of summons, but I have had the summonses extended for a further period.

*Coconut scale.*—Owing to the absence of transport facilities I was unable to visit any distant areas. Scale is reported from Lau and I am endeavouring to secure specimens as I am assured by various masters of cutters that it is not the disease noticed on Ovalau.

Scale still continues at Bureta and Moturiki. Trees in these areas are not recovering very quickly from the treatment ordered last year. Bearing trees are few and far between.

I propose leaving early in February for Koro, Gau, &c.

*Clidemia hirta.*—As reported before this is very prevalent on the eastern side of Ovalau and extends right round to within a few miles on either side of Levuka. The Fijians call it "Bona na Bula ma Rau." Bureta Estate is almost covered and it is spreading rapidly. It is very heavy close to several Fijian villages and great difficulty will be experienced in inducing them to clear it.

### FEBRUARY.

*Inspection of vessels.*—Thirty-six vessels were inspected during the month and material destroyed in seven cases. It is rather disappointing that the police are failing to serve summonses on masters of cutters who have evaded the regulations. I have again extended the time and have in two instances traced the men myself to towns in other districts where they have gone on purpose to avoid service. I am anxious to secure a conviction against one at least of these for he has deliberately traded between Tailevu and Gau.

*Coconut scale.*—I was able during the month to pay a visit of inspection to Koro and Gau. At Koro no scale or sign of it was discovered. Trees are remarkably healthy and bearing very well. The leaf-miner and stick insect do not appear to be troublesome in this island either. Undergrowth is very thick all through. There is only the one European plantation on the island.

Gau.—I visited areas where yaqona was infested previously and treated with lime sulphur solution. Those patches treated show no sign of the scale now, but at Waikama a small area of yaqona not previously noticed was found to be infested. These plants were immediately treated. A close inspection of coconuts, bananas and other trees in the vicinity showed no sign of infection. A coconut forwarded to me by Mr. Steinmetz of Munia is infested with the scale. Mr. Steinmetz's letter has not reached me. I am not yet aware from whence the nut came. I shall investigate and report later. There is no sign on the islands visited of any *Clidemia hirta*. I have noted the Gazette Notice referring to this curse. I am leaving in a day or two to start operations on the eastern side of the island. I notice that its destruction by weedicide is permitted. This may help to solve the difficulty of getting the Fijians to eradicate it. Can you give me the composition of the most effective spray please? The expense might be borne by the Provincial Funds and I could more easily supervise this method than the eradication by digging.

APRIL.

*Inspection of vessels.*—During the month 33 vessels were inspected and material was destroyed in 12 cases. Owing to the low price of copra many vessels have been laid up for lack of trade. Several cases of the evasion of the regulations in regard to the inspection of vessels, set down for hearing last month, were abandoned, the police having failed to serve the summonses. The offenders had in each instance left their district and so far have not been located. Native constables are employed in this work and I am rather inclined to believe warn the men to disappear. However, I am making other arrangements for the future which will I hope be more successful.

*Coconut scale.*—The position in regard to this is much the same as reported a few weeks ago. The exceptionally inclement weather has prevented me reaching any outlying islands, no boats being available. The reported outbreak of scale proved to be a scale other than the destructor, and which apparently attacks the nuts only, without visible damage. Parasitised palms were received from Mr. Simmonds during the month and placed at Bureta and Moturiki. The last lot arrived during very bad weather, and fearing they would not survive I placed them in shelter until the weather moderated.

*Clidemia hirta.*—A certain amount of work has been done towards eradicating this weed, but progress, especially where natives are concerned, is very slow. The communal system under which the native is governed provides a roster of the work they should do for the whole year and prosecutions follow their failure to carry out the work as laid down. There is no provision for special work such as is required by us. If notice is served on individual natives to clear their land of this curse it would be ignored and the plea set up that their set tasks prevented them carrying out the order. As nearly every native is a landowner the prosecutions that would follow would cause considerable feeling. It is possible that I can arrange with the Roko to have a certain number of men detailed from each village for this work, but it would take months to make any impression on the large area affected on this island, that is unless a weedicide may be used. With this and constant supervision it will be possible to make some progress.

I propose to leave this week for Macuata to investigate a reported outbreak of coconut scale there and will work round the coast through Wainunu

to Savusavu Bay, and will be away two or perhaps three weeks. Wainunu has a lot of Koster's Curse to get rid of and though European planters are attempting it the natives have not done anything.

*Stock.*—No stock was imported during the month.

*Fruit.*—A few cases each of apples, plums, peaches and pears were imported, examined and found in excellent condition.

## METEOROLOGICAL OBSERVATIONS, SUVA.

| JANUARY. | | | FEBRUARY. | | | MARCH. | | | APRIL. | | | MAY. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. | Min. | Rain. | Max. | Min. | Rain. | Max. | Min. | Rain. | Max. | Min. | Rain. | Max. | Min. | Rain. |
| 80·4 | 71·8 | 0·30 | 86·8 | 72·2 | 1·09 | 86·4 | 73·0 | — | 85·6 | 70·2 | — | 88·2 | 72·2 | ·19 |
| 81·2 | 71·4 | 0·58 | 89·8 | 72·0 | 0·11 | 90·6 | 74·6 | 0·10 | 86·2 | 72·8 | 0·35 | 87·4 | 71·0 | ·10 |
| 83·4 | 73·0 | 0·39 | 88·4 | 72·6 | 0·25 | 89·6 | 72·4 | — | 85·0 | 79·5 | — | 88·0 | 72·2 | 1·0 |
| 86·6 | 73·2 | 0·56 | 87·4 | 75·0 | 0·02 | 88·4 | 73·2 | 0·20 | 86·8 | 76·4 | 0·75 | 86·2 | 70·4 | ·75 |
| 89·8 | 73·6 | 0·10 | 89·6 | 72·4 | 0·38 | 86·2 | 74·6 | 0·20 | 84·6 | 78·2 | 1·20 | 87·4 | 72·6 | 1·40 |
| 87·4 | 73·0 | 2·06 | 87·8 | 75·0 | 0·19 | 88·6 | 75·2 | 0·10 | 85·2 | 70·4 | — | 86·2 | 71·8 | ·68 |
| 86·0 | 73·6 | 0·21 | 88·2 | 75·4 | 0·02 | 86·8 | 73·4 | 0·10 | 85·6 | 72·2 | — | 87·6 | 73·2 | — |
| 85·6 | 74·4 | 0·14 | 90·0 | 77·0 | — | 89·6 | 73·2 | — | 86·2 | 73·6 | — | 88·2 | 74·8 | — |
| 86·0 | 73·0 | 3·07 | 90·4 | 75·2 | 0·02 | 90·4 | 74·8 | — | 85·6 | 72·4 | — | 87·4 | 73·2 | — |
| 83·0 | 72·6 | 1·44 | 90·0 | 75·4 | 0·38 | 88·6 | 72·4 | — | 85·4 | 70·4 | — | 86·2 | 72·4 | ·05 |
| 83·4 | 72·2 | 0·94 | 90·4 | 75·0 | 0·13 | 89·2 | 74·6 | 0·10 | 83·0 | 72·2 | — | 87·0 | 72·8 | ·20 |
| 85·0 | 71·8 | 1·48 | 86·4 | 74·2 | 0·30 | 88·8 | 72·4 | 0·06 | 85·2 | 71·4 | 0·37 | 86·4 | 70·2 | ·10 |
| 84·6 | 72·8 | — | 84·6 | 76·6 | 0·63 | 86·4 | 71·8 | 2·17 | 86·8 | 70·6 | — | 88·2 | 73·6 | — |
| 88·0 | 72·2 | — | 86·4 | 74·2 | — | 81·2 | 70·6 | 1·23 | 86·4 | 70·2 | 0·52 | 88·2 | 71·5 | — |
| 87·6 | 74·4 | — | 87·0 | 74·0 | 0·60 | 89·4 | 71·0 | 0·20 | 84·2 | 68·4 | 1·10 | 88·2 | 72·0 | — |
| 88·8 | 74·6 | — | 89·2 | 74·8 | — | 88·2 | 72·0 | 2·25 | 85·0 | 68·0 | 1·40 | 88·2 | 74·6 | — |
| 88·2 | 75·0 | 0·77 | 90·0 | 74·2 | 0·03 | 89·4 | 72·6 | 0·24 | 88·5 | 78·5 | ·36 | 87·0 | 73·4 | — |
| 85·2 | 75·2 | — | 88·0 | 76·2 | 0·01 | 90·2 | 71·4 | 2·0 | 88·3 | 74·8 | ·94 | 86·4 | 70·2 | — |
| 88·0 | 75·0 | — | 86·8 | 76·4 | 0·19 | 90·6 | 72·8 | 0·06 | 87·4 | 76·2 | ·29 | 85·6 | 67·4 | 1·18 |
| 89·0 | 73·0 | 0·46 | 88·4 | 77·6 | 2·68 | 86·0 | 72·2 | 0·40 | 84·6 | 69·4 | 4·10 | 84·2 | 70·0 | — |
| 89·6 | 73·2 | 0·08 | 76·6 | 72·6 | — | 84·4 | 74·4 | 0·30 | 88·2 | 68·2 | ·72 | 88·2 | 72·0 | ·27 |
| 88·0 | 74·0 | 0·07 | 81·6 | 71·0 | 3·25 | 88·4 | 74·8 | — | 88·2 | 74·2 | 2·73 | 88·2 | 73·2 | ·05 |
| 88·6 | 72·0 | 0·41 | 81·4 | 70·4 | 0·45 | 89·2 | 72·4 | — | 88·3 | 74·0 | 5·79 | 87·4 | 69·6 | — |
| 89·0 | 73·8 | 0·05 | 82·4 | 73·4 | 0·02 | 89·2 | 71·2 | 0·41 | 88·2 | 71·5 | 3·60 | 88·8 | 73·0 | ·03 |
| 85·2 | 72·4 | 3·66 | 88·6 | 75·2 | 0·45 | 89·0 | 71·2 | 0·22 | 87·4 | 74·0 | ·20 | 88·0 | 72·4 | ·20 |
| 88·4 | 72·8 | 2·04 | 87·4 | 74·8 | 0·05 | 82·6 | 73·0 | 0·42 | 86·2 | 72·4 | 1·60 | 86·4 | 71·6 | ·10 |
| 86·4 | 72·2 | 0·17 | 87·4 | 74·8 | 0·13 | 78·0 | 72·0 | 0·22 | 80·8 | 69·2 | ·80 | 88·0 | 74·8 | ·06 |
| 86·8 | 73·0 | 0·26 | 87·2 | 73·4 | — | 90·0 | 73·0 | — | 82·4 | 71·6 | ·08 | 87·4 | 74·8 | ·23 |
| 85·8 | 73·0 | — | | | | 85·2 | 76·2 | 0·41 | 84·0 | 70·8 | — | 88·2 | 72·4 | 2·22 |
| 85·0 | 73·0 | — | | | | 86·4 | 70·0 | 0·45 | 83·4 | 68·2 | ·12 | 88·0 | 72·8 | ·05 |
| 86·6 | 72·4 | 1·25 | | | | 85·2 | 71·4 | 0·80 | | | | 87·4 | 70·2 | — |
| | | 20·49 | | | 11·38 | | | 12·64 | | | 27·02 | | | 8·86 |

# Agricultural Associations in Fiji.

## THE COUNCIL OF PLANTERS OF FIJI.

*Chairman*.....MR. J. L. HUNT.

*Vice-Chairman*.....MR. E. DUNCAN.

*Secretary and Treasurer*.....A. E. S. KEELY.

### ASSOCIATED BODIES.

THE CAKAUDROVE COPRA GROWERS' ASSOCIATION.

THE CANE GROWERS' ASSOCIATION OF FIJI (BA AND NADI BRANCHES.)

THE LABASA PLANTERS' ASSOCIATION.

THE SAVUSAVU PLANTERS' ASSOCIATION.

THE SOUTHERN DISTRICTS PLANTERS' ASSOCIATION.

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